# ASTRONAUTICS

*Journal of the American Rocket Society*

Number 54 February, 1943


**BRITISH SEAMEN PREPARE SNARE ROCKET—** (British Combine)

**Wire tail is being attached to anti-aircraft rocket prior to inserting device into launching gun. After vertical ascent rocket will float slowly down by parachute, its long dangling wire tail capable of entangling and bringing down Nazi dive-bombers. Salvos of these rockets are fired upon approach of enemy aircraft.**

**THE AMERICAN ROCKET SOCIETY** was founded to aid in the scientific and engineering development of jet propulsion and its application to communication and transportation. Three types of membership are offered: **Active**, for experimenters and others with suitable training; **Associate**, for those wishing to aid in research and publication of results, and **Junior**, for High School Students and others under 18. For information regarding membership, write to the Secretary, American Rocket Society, 130 West 42nd Street, New York City.



## NOTES AND NEWS

"Few things are more terrifying than to see a heavily loaded bomber, full of bombs and gasoline, taking-off at night with a hugh rocket blazing under each wing." These are the words of an escaped Dutch pilot confirming our beliefs that the Nazis are using booster rockets for auxiliary take-off power.

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In a recent discussion in the English House of Parliament Cdr. Locker-Lampson asked the Minister of Aircraft Production whether the research departments are continuing their experiments with rocket-propelled bombs. The Minister of A. P. replied in the affirmative but declined to give any further information on the subject.

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Following the successful flights of the Campini thermal-air-jet propelled airplane several other countries have started investigations of the potentialities of this type aircraft. Reports from France mention a design of R. Ledru which is said to be under construction in the L. Breguet plant in Toulouse. Similar in detail to the Campini aircraft as far as operation is concerned, the Ledru plane is to be powered by a 1200 h. p. VUIA steam turbine.

The Aeronautical Research Laboratory in Tokyo has received a grant of 35,000,000 yen (about 17 million

(Continued on Page 16)

# Hydraulic Jet Propulsion

by CEDRIC GILES

The idea of propelling a vessel by the ejecting of a stream of water from the stern is probably one of the oldest methods of mechanically driving a vessel. This tpye of propulsion is very similar to the better known subject of thermal atmospheric rocket propulsion, both methods being based on the same jet reaction principle and many of the problems confronting them being of a kindred nature.

The main advantages presented by the advocates of the hydraulic propulsion system have been:

1. The possibility of offering a smooth hull line, unbroken by any protuberances, as a screw, to the surrounding waters.

2. Elimination of the dangers involved in the screw racing with subsequent injury to the motors.

3. The jet system inlets, when amidships, are always immersed.

4. Possible damage to the screw in striking a submerged object.

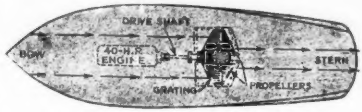
5. Elimination of screw-propeller vibration.

6. Full engine power available for maneuvering.

7. The absence of rudder drag in cases where the steering is accomplished by action of the jets.

8. Vessels employing the jet system could navigate in the shallowest of waters, and even drive over obstructions.

The principle drawbacks which have led to the condemning of the "Jet" have been the need for space in




**Jet propelled boat for shallow water navigation.**

the vessel for large diameter pipes carrying the propelling water to and from the pumps, the possibility of sand or mud clogging the inlet orifices, the high friction in the water pipes, and the lower efficiency per pint of fuel in comparison to the modern screw propeller.

**Early Developments**

Long before man considered the practicability of creating a propulsive force by reaction, nature endowed a division of the mollusks with the power to propel themselves ahead by the expulsion of a fluid. As man progressed, his inventive genius continued to devise new and better methods of propelling water vehicles first manually, then mechanically.

In a pamphlet issued by J. A. Genevois, a Swiss pastor, in London 1760, mention is made of a Scotchman who thirty years previous had propounded a plan for propelling vessels by the recoil of fired cannon.

**Jet Propulsion Idea**

One of the earliest known records on hydraulic propulsion was the

granting of a patent on February 8, 1661 to Messrs. Thomas Toogood and James Hayes for the invention of a method of forcing water through a vessel for use in navigating. In the year 1729, John Allen, M. D., received a patent on the principle of a boat propelled by pumping a quantity of water in at the bow and ejecting it at the stern.

A new method of navigation resulting from the power obtained from ejecting a quantity of fluids is described in Daniel Bernouilli's "Hydrodynamics", in 1738. The jet scheme was offered for consideration to the Assembly of Pennsylvania in 1776 by Arthur Donaldson who had experimented for some time with a hydraulic propelled model.

Dr. Benjamin Franklin, around 1785 became interested in this new form of propulsion and not only referred to it in his numerous writings but is believed to have introduced it into France. Tests conducted about this time by James Watt with a water jet engine propelled a boat at a very low speed.

**Steam Navigation**

With the advent of steam being recognized as a possible source of power for navigation, attempts to harness this new giant were undertaken with varying degrees of success. The majority of early experimenters in using steam as motive power appear to have encountered most of their difficulty in constructing pressure-tight boilers for their hydraulic systems.

**First Successful Steamboat**

On December 3, 1787, James Rumsey of Virginia, demonstrated before the people of Shepardstown, West Virginia, the first successful hydraulic jet propelled steamboat. Rumsey's steamboat made a number of trial runs up and down the Potomac River averaging about 3 miles per hour. Major-General Horatio Gates of the Continental Army, Rev. Robert Stubbs and others who were present certified to the successful tests.

A week later, December 11th, the "flying boat" was displayed a second time, this time going against the river current at a speed of 4 miles an hour. It was thought that the boat might have made a speed of 7 miles an hour if water freezing in the hydraulic system had not ruptured the boiler and pipes the previous night. These public trials of Rumsey's boat took place 20 years before Fulton's paddlewheel steamboat, the Clermont.

About a month later Rumsey published "A Plan Wherein the Power of Steam is Fully Shown", in which he describes how the water was sucked into a long trunk by a steam-driven piston in a cylinder and on the piston's down stroke the water was forced through the trunk and out

the stern of the boat with considerable velocity.

The United States on August 26, 1791 issued a patent to Rumsey for propelling a boat by jet propulsion. A model of Rumsey's boat is on exhibit in the Smithsonian Institute in Washington, D. C.

**Other American Pioneers**

John Fitch, a great rival of Rumsey's, experimented with the idea in 1786 of driving land carriages and vessels by steam. For many years a controversial issue between Fitch and Rumsey concerned the priority of the use of steam as a prime mover for vessels. Fitch, after some ill-fated tests, rejected the pure jet method and turned to other means of propulsion.

About 1802, Colonel John Stevens, Chancellor Livingston, Nicholas J. Roosevelt, and Isambard Brunel made tests on the Passaic River, N. J. with steam propulsion. Their method consisted of drawing water through the bottom of a 30 ton boat by a horizontal centrifugal wheel and expelling it at the stern.

**The Ruthven Jet Propeller**

A patent for improvements on a centrifugal fan for forcing water out of the sides of vessels for propulsion was granted on August 10, 1849 to John Ruthven, of Edinburgh.

Fitted in 1853 with the Ruthven jet device a Prussian vessel successfully operated on the Oder River for a number of years. Following this, the Ruthven equipped British vessel, Seraing, in a series of special tests with a paddle-wheel vessel, showed a much greater speed.

As a result of this experiment, the armoured gunboat, H.M.S. Waterwitch, was built by the Admiralty, in 1866. The Ruthven propeller with which she was fitted resembled the usual type of turbine apparatus, with the addition of multiple intakes and side ejection nozzles in line with the keel.

The vessel was 162 feet long, with a 32 foot beam, and weighed over 1000 tons. Her turbine wheel when running at high speed could eject over 300 tons of water per minute. The Waterwitch did a mile in 6½ minutes on her trial run, or about 9 miles an hour. Later she was used as a test model against twin-screw gunboats.

The Admiralty was induced in 1881 to have Messrs. Thornycroft embody the jet propulsion system in a second class torpedo boat. With the turbine propeller discharging 30 tons of water per minute the boat attained a speed of 13 miles an hour.

**The Primavista**

Walter Marsh Jackson, M. D. of New York City, published a pamphlet, in 1888, wherein description is given of his first water-propelled vessel, the Primavista. The boat had a length of 50 feet, a beam of 5½ feet, and weighed 21,000 pounds. She was driven at a speed of ten miles an hour by a propulsive outlet just "one quarter of an inch in diameter".

This remarkable accomplishment was attributed by Dr. Jackson to the fact that where past experimenters had sent astern a large mass of water with a small velocity, the Primavista employed a relatively small quantity of water propelled at great velocity. He also deduced that a vessel in motion must have the speed of the discharged water increased in order to obtain the same efficiency as when the vessel is under static tests.

Dr. Jackson predicted the use of great hydraulic pressures for propelling vessels both above and under the surface of the sea, driving torpedoes at enemy ships, and the firing of bullets or projectiles from a "hydraulic battery". He also proclaimed that neither a Barker's mill or a rocket would move in a vacuum.

**Britian's Life-boats**

The Royal National Life-boat Institution after some years of experimenting, decided in June 1888 to build the first steam jet-driven lifeboat, the Duke of Northumberland. Horizontal coal-fueled engines drove a pump which sucked in water through the bottom of the boat and ejected it through a nozzle on each side. With the pump working at its maximum a ton of water could be ejected each second, from which the 50 foot lifeboat attained a 9 knot speed.

During her initial trials, the Prince of Wales, later His Majesty King Edward VII, and the German Emperor had a ride in her. A few years later two other jet propelled lifeboats were built and then the RNLI turned to screw-propelled boats.

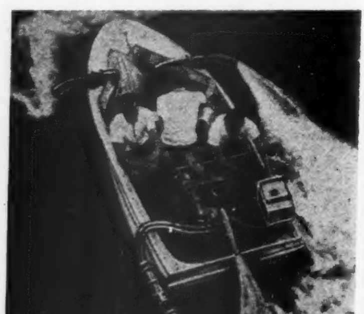
A later lifeboat, the President von Heel, 1897, was approximately the same as the earlier jet types of lifeboats. The boat was able to steer by the centrifugal pump-driven jet alone, although a rudder was attached for easier handling. Tests showed that when using speed above those for which designed there appeared to be a large power loss. Instead of the regular external reversing nozzle, discharge pipes were carried both forward and aft and the water was controlled by a number of distributing valves.

**Hydraulic Motor Boats**

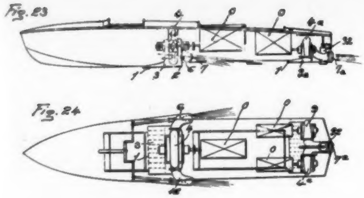
Along about 1904-5 Mr. Rankin Kennedy of Glasgow conducted experiments on the Clyde with a small boat. A centrifugal pump fed a jet of water at double the boat's speed, or about 8 knots. An increase in efficiency was claimed by using a U turn in the discharge pipe rather than the usual right angle bend. Under the same conditions the jet system gave a better efficiency per pint of fuel than a screw propeller.

The Hotchkiss Hydraulic Propeller Company in Cornhill, England built a number of hydraulic propelled boats, among them being the Silver Queen, a 24 foot motor launch having a speed of 6 knots, and a 40 foot shallow draught tugboat. These boats made use of the Hotchkiss centrifugal pump apparatus.

A similar type of boat was also designed by a Mr. Ocenasek, a Czech engineer, in 1937. A 4 h. p. motor drew up water through multiple openings in the bottom and ejected it through nozzles, giving a claimed speed of 16 m. p. h. to the small boat.



**Ejection was above water in Ocenasek launch.**



Campini design. Intakes indicated at 1, exhausts at 7 and 7a.

### Recent Lifeboats

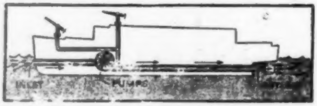
During recent years the Royal National Life-boat Institution has again experimented with pump-propelled boats, building in 1939, a new surf-type of lifeboat, the 32 foot Kate Greatorex, for the Minehead Station.

A horizontally opposed flat twin-cylinder engine through reduction gears drives two Gill hydraulic pump units, one on each side of the boat. The high velocity water stream was discharged below the waterline, with the jets controlled by a deflecting nozzle. The boat had a normal speed of 5½ knots with one unit working, and 6½ knots speed with both.

For sometime the U. S. Coast Guard used a number of jet propelled Lundeen lifeboats at the Seattle Harbor District.

### The Handley Fireboats

One hundred and fifty-five years after Rumsey's epic demonstration, a second water-propelled craft was exhibited on the Potomac River on September 11, 1942. This latest acquisition to the hydraulic jet propulsion principle was the all-metal "Centridrive" fireboat constructed for the Coast Guard by the Handley Engineering Service of Prospect, Ohio.



Handley "Centrifuge" fireboat.

The 38 foot boat has a beam of 10 feet 6 inches, a draft of 18 inches and carries a crew of four. Centrifugal pumps driven by gasoline engines draw water from the bow and discharge it astern to propel the boat forward. By reversing the process the boat is driven in the opposite direction. Nozzles mounted on the deck and superstructure shoot streams of water for fire fighting some 200 feet high.

### Campini Patent

Of the many patents granted to inventors, the best known is probably the U. S. patent No. 2,024,274 which was issued on December 17, 1935 to S. Campini, the inventor of the famous thermal jet propelled plane which was tested last year in Italy. His patent describes a power plant for the reaction-propulsion of aircraft or watercraft.

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### References

Fletcher, R. A., Steam-ships, 1910.

Turner, Ella May, James Rumsey, 1930.

Jackson, Dr. Walter Marsh, New Method of Hydraulic Marine Propulsion, May 1888.

Dawson, Major A. J., The Life-boat, Royal National Life-boat Institution, 1890.

Barnaby, Sidney Walker, Hydraulic Life-boats, 1897.

The Practical Engineer, London, 1905, 1922.

# Wire-Tailed "Snare" Rockets

**Defend Small Ships from Air Attacks**

For some time stories have been coming out of England telling of wire-tailed rockets used by merchant shipping to keep off Nazi dive-bomb and machine gun attacks. The accompanying photographs are the first to be released and show the actual rocket device in operation.

It appears, from the photograph reproduced on our cover, that the rocket is powered by a conventional black powder rocket charge of the type designated as "4 lb". As described in our last issue this tube of gunpowder actually weighs less than a pound, and contains less than one-half pound of powder. It delivers an average thrust of about 17 pounds for 2.8 seconds. With the combined weight of parachute and wire snare it is doubtful if the rocket ascends more than 500 feet. It is possible, however, that the charge is of more powerful composition than ordinary gunpowder and thus may rise to a higher altitude.

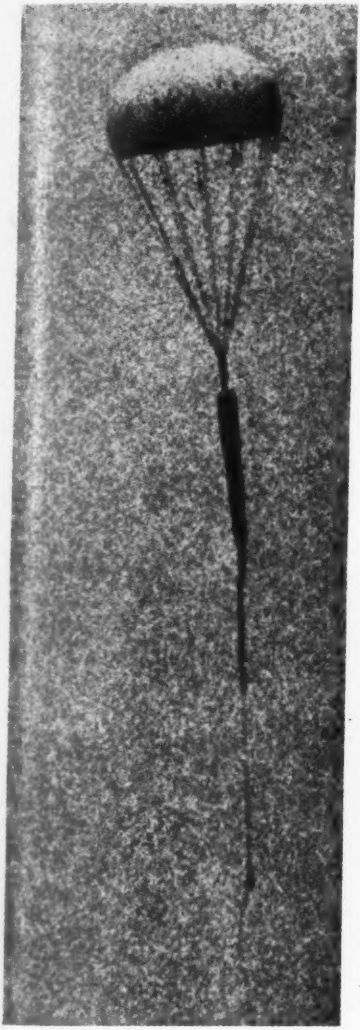
British Combine

**Rocket is fired.**

The launching device is a simple metal tube set up on four legs and a base plate. Two metal rods attached to the side of the rocket are hooked onto a fitting connected with one end of a roll of wire in a container. The lower portion of the rocket charge is slipped into the launching tube. Ignition is apparently accomplished by pulling on a string which brings a small alcohol burner into line with the rocket charge.

(British Combine)

**Showing simple launching device.**



(British Combine)

Snare wire dangles as rocket floats down.

To be effective it seems necessary that a number of these rockets be fired simultaneously to form a wire curtain over the ship. It would be an easy matter to incorporate a number of launching tubes, of the type shown, into a battery operated by one man.

As with the London barrage balloon the main effect of these rockets is psychological, keeping the Nazi airplanes at a more respectful distance. The wire snare could, however, bring down an airplane which had the misfortune to fly into it. At least one instance is reported of a Nazi pilot, startled by the sudden zoom of a snare rocket across his path losing control of his plane and crashing into the waters of the English Channel.

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Word of rocket doings in Australia is of extreme interest due to the continent's importance in the war. In correspondence to the ARS, Mr. J. A. Georges, president of the Australian Rocket Society, mentions that the present Society was founded in June 1941; there being no connection to the old society with the same name, that having been dissolved for some time. The Society has improved considerably of late and it is hoped that during the coming year opportunity may be found for rocket research.

Mr. Georges also writes:

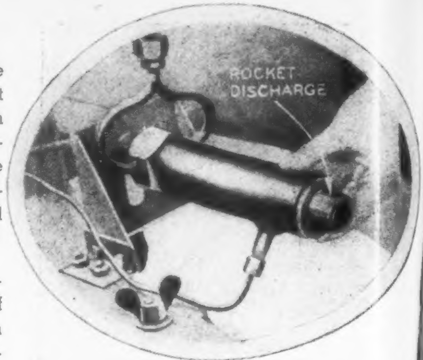
**"I've been doing a lot of theoretical work in the rocket line and have turned out a few gadgets. All of them aim at being inexpensive to produce. The chief two are an automatic rocket control, and a system for feeding fuel into the combustion chamber."**

**"In an effort to cut down the cost of research, I've invented a couple of simple rockets, which I reckon can be built for about two dollars each. I've called them the "Duroc" and "Duproc" respectively, and intend to try out a few models of each class within the next few months."**

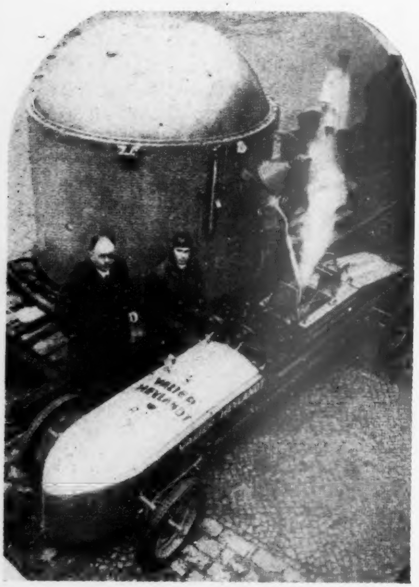
# Valier Motor

It is an unfortunate fact that some of the most interesting European rocket experimental work took place when this Society was engrossed in interplanetary matters, and payed little heed to such mundane things as regeneration, Dewar flasks, valves and fuel tanks.

Outstanding among the German experimenters was Max Valier, one of the first martyrs to the cause. Early in 1931 Valier, who had conducted numerous powder rocket experiments, interested Dr. Paul Heylandt in the possibilities of jet propulsion. Dr. Heylandt, one of Germany's leading experts on and manufacturer of liquified gases, agreed to finance the development of a rocket motor.




**Motor was evidently of regenerative design.**



**Valier and Heylandt prepare for test run.**

In the early part of 1931 the motor had been evolved to the point where a public demonstration was possible. Valier mounted it on an auto chassis, with the necessary fuel tanks and lines, and drove it around Templehof Airport, near Berlin. After driving around the field, and demonstrating complete control of the motor, Valier accidently burned out the motor with too oxidizing a mixture.

During May of that year Valier was killed, while making preparations for another demonstration, when some part of the apparatus exploded. Dr. Heylandt and his assistant Alfons Pietsch continued experiments and are reported to have developed an 8 lb. motor generating 263 lbs. thrust; a 16½ lb. motor giving 440 lbs. reaction and a larger unit, weighing 25 lbs. and developing about 1000 lbs. thrust. What progress has been made with these motors since that time is not known, nor is any data available on the above motors.

R. H.

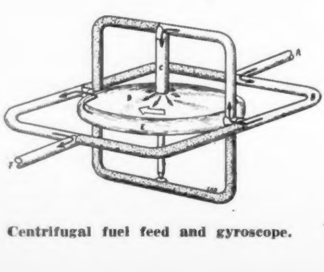
# Combination Centrifugal Fuel Feed and Control Gyroscope

By Keith Buchanan

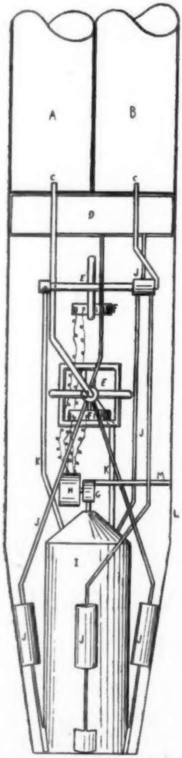
The illustration shows a control gyroscope in combination with a centrifugal fuel feed as proposed in "Astronautics" No. 47 by Louis Goodman. The control gyroscope would presumably be used in some system similar to Dr. Goddard's as presented in Patent No. 1,879,187. Its advantages will be obvious - with the combination device, separate pumps and gyroscopes will be rendered unnecessary, cutting down on weight.

Perhaps the combustion gases escaping through a small opening at the top of the rocket motor could be used to operate a turbo-generator which would in turn keep the gyroscopes spinning by electric motors mounted on their frames.

In the first drawing A is the fuel inlet and B a hollow portion of the gymbal through which the fuel passes. C is the hollow exle through which the fuel enters the rotating reservoir D. The centrifugal force pushing the fuel under pressure into the stationary annular ring E, the fuel flows through a hollow gimbal and out through the tube F and finally into the combustion chamber.



Centrifugal fuel feed and gyroscope.



Sketch of fuel and stabilization systems of rocket using combination gyro-fuel feed.

**KEY**

A—Liquid Oxygen Tank
B—Fuel Tank
C—Tubes to Fuel Feed Gyros
D—Pressure Tank for Stabilization System
E—Combination Control Gyro-Centrifugal Fuel Feed
F—Electric Gyro Motor
G—Turbine (Operated by Small Amounts of Combustion Gases)
H—Generator
I—Rocket Motor
J—Parts of Goddard Control System (Pat. 1,879,187).
K—Tubes from Fuel Feed to Rocket Motor
L—Outer Shell or Casing
M—Turbine Exhaust Tube

# Semi-Rocket Airfoil

**A SUGGESTED DESIGN FOR HIGH-SPEED FLIGHT**

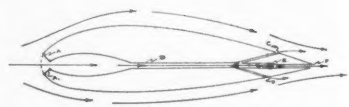
**by Charles T. Piecewicz and Gustav A. Kindsvogel**

Since the flight of the Caproni-Campini thermal-air-jet- propelled airplane interest has been revived in utilizing air more effectively to increase the efficiency of aircraft. While the Campini plane uses the fuselage as the main component for the thermal air stream the authors have extended the principle further to include also the airfoil of a plane. The idea is outlined in the sketch on this page.

### Modern Trends

It must be obvious to every rocketeer that as the speed of our airplanes becomes faster it becomes evident that air - the medium which makes for flight - actually retards the plane and becomes a hindrance at high speeds. At super-speeds it is believed a semi-vacuum forms behind the trailing edge of the wing and lift does not increase as rapidly as drag.

The secret of a good airfoil is to have the air flow around it in such a fashion that it increases the lift without excessive drag at flight speeds. One possible solution is to fashion a streamlined passageway through the center of the airfoil, passing the air through a turbine and exhausting it at the trailing edge. This would give the airfoil a semi-rocket characteristic which would increase the efficiency. Only a small part of the air on the leading edge would have to be passed through the wing passage. This would also help fill up the area of low pressure



Semi-rocket airfoil.

at the rear of the airfoil and by better redistribution increase the efficiency of high-speed airfoils. The authors have designed a semi-rocket airfoil based on the Venturi principle which will be less efficient than the Campini design but will do away with a heavy turbine.

### Design Explanation

Following the above sketch it is seen that an airplane takes-off with the passageway A A closed at the leading edge. When the plane is in full flight the hinged flaps, also shown by A A, open up gradually. Air sweeping over the upper and lower surfaces of the airfoil at high speeds causes a partial vacuum near the trailing edge and air is pulled along through B to relieve the pressure on the leading edge.

Assuming the plane is powered with an aircraft engine, the engine's exhaust manifold is connected with duct E which runs spanwise inside the rear of the wing. Heated air from the rear of the engine might also be used for this purpose, or a turbine

might be used to keep the stream under pressure. Thus a stream of heated air and/or gases will continuously flow out of the rear of duct E. Air entering at A A will be speeded up at B, due to Venturi effect then divided up, part passing out slots C and D, to fill up the low pressure area at rear of wing, and the balance being led through F where it picks up thermal energy and exhausts with a definite propulsive effect.

The design is intended for an orthodox type aircraft but the principle can readily be adopted to a purely jet-propelled aircraft. As aircraft speeds become higher it becomes very evident that we must look to new methods and approaches of using the full available energy of our engines and airfoils to make the most efficient possible combination.

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From a review of rocket articles appearing in foreign publications it seems likely that a number of British societies have either survived the war to a large degree or are in the process of reformation. Other than the Manchester Astronautical Association, which was reported on in the last issue of ASTRONAUTICS, these societies are: the British Interplanetary Society, the Manchester Interplanetary Society, and the Astronautical Development Society.

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Mr. R. L. Farnsworth, member of the ARS, recently founded the United States Rocket Society with headquarters at 781 Riford Road, Glen Ellyn, Illinois. The Society is acquiring a library on rocketry and expects to publish a news organ as soon as economically possible.

## ROCKET QUERIES

**Question:**

Is the heat content (B.T.U.) of gasoline 3, 5, or 10 times greater than T.N.T.?

**Answer:**

Gasoline contains 3 times the potential energy per pound found in T.N.T. (Trinitrotoluene). The reason for this is that T.N.T. has the oxygen necessary for its combustion contained within itself. Gasoline obtains oxygen for combustion purposes from the surrounding air.

In a rocket motor oxygen in the form of a liquid is carried along as the oxidizing agent for the fuel. If the oxygen weight is added to the gasoline's, then T.N.T. will have more B.T.U. per lb. of compound, as shown in the accompanying table.

**Question:**

When considered on the ratio of their weights and B.T.U. is gasoline or alcohol the better fuel?

**Answer:**

Gasoline's measure of heat per lb. is about 19,000 B.T.U., while alcohol's heat energy may be placed at 12,000 B.T.U. For complete combustion in the rocket motor, gasoline requires 3.5 lbs. of oxygen for each lb. of fuel. Alcohol needs approximately 2 lbs. of oxygen per fuel lb. Comparison of the two fuels is explained in the following table.

**Rocket Queries**

| Explosive | B.T.U. per lb. | Lbs. ox. needed | B.T.U. per lb. of compound |
|---|---|---|---|
| Gasoline | 19,000 | 3.5 | 4,222 |
| Alcohol | 12,000 | 2.0 | 4,000 |
| T.N.T. | 6,500 | .0 | 6,500 |

### ROCKET ARTICLES OF 1942

At the present time newspapers and magazines are printing articles on the subject of jet propulsion with increasing frequency. A partial list of articles follows:

First Successful Jet-Propelled Aeroplane, Illustrated London News, Jan. 10, 1942.

Thermal-Air-Jet-Propulsion, Aircraft Engineer, Feb.

Military Rockets, Scientific American, Feb.

Lunar Space Vessel, Flight, London, Feb. 12.

More About Jet Propulsion, Flight, Feb. 19.

New Ideas on Propulsion, Flight, April 30.

This Plane Flies With No Propeller, Mechanix Illustrated, May

Propless Plane, Popular Science, Ma

Three Rocket Weapons in Use, Science News Letter, June 6

Who'll be First to Invade the Moon? American Weekly, June 14

Auxiliary Turbines for Rocket Aircraft, Science News Letter, June 27

Rocket Bombs, Time, June 29

The Future of Rocket Planes, Air Progress, July

Rocket Motors on War Planes, Science Digest, August

Prevention of Rocket Motor Burnout, Flight, August 6

The Airplane of Tomorrow, Mechanix Illustrated, September

Rocket Models, Air Trails, Oct.

Jet Propulsion, Tomorrow's Power? Air Progress, October

Rocket Planes Next? Science News Letter, October 24

Powered by Hot Air, Flying, Nov.

Rockets in This War, Mechanix Illustrated, November

Rocket Bombs, Air Trails, December

Jet Propulsion Developments, Automotive and Aviation Industries, Sept. 15.

Rocket Power for Assisted Take-off, Aviation Jan. 1943.

## BOOK REVIEWS

**Recent Results in Rocket Flight Technique. Eugen Sanger. Translation of an article entitled "Neure Ergebnisse der Raketenflugtechnik", from Flug, December, 1934.** The concept of the effective ejection velocity of a rocket engine is explained. Also, the magnitude of the attainable ejection velocity is theoretically and experimentally investigated.

Velocities above 3000 meters per second (6700 mph) are actually measured and the possibilities of further increases shown. N. A. C. A. T. M. No. 1012, April 1942, 47 pages, 24 illustrations.

**Shells and Shooting, by Willy Ley. Modern Age Books, Inc., New York, 1942; 223 pages, $2.00.**

In this work Mr. Ley, former secretary of the German Interplanetary Society, traces the development of all modern arms from the first crude tubular device of the Dark Ages.

An appendix of 28 pages, part of which originally appeared in the Coast Artillery Journal, May-June 1941, describes the various types of rockets in battles. From early Chinese rockets, rockets as a weapon of war are described in chronological order, with particular reference to the drawings of Joanes de Fontana, Congreve war rockets, the battles of Leipzig and of Danzig, the Hale rocket, and modern Russian penetration rockets.

## MORE ROCKET PATENTS

No. 757,825, "Rocket Apparatus for Taking Photographs"; granted to Alfred Maul, of Dresden, Germany.

No. 1,191,299, "Rocket Apparatus"; granted to Robert H. Goddard, of Worcester, Mass.

No. 1,194,496, "Rocket Apparatus"; granted to Robert H. Goddard, of Worcester, Mass.

No. 1,362,997, "Propelling Apparatus"; granted to Boris Koleroff, of New York, N. Y.

No. 1,903,303, "Flying Rocket"; granted to Reinhold Tiling, of Osnabruck, Germany.

No. 2,016,921, "Means for Cooling Combustion Chambers"; granted to Robert H. Goddard, of Worcester, Mass.

No. 2,026,885, "Aircraft"; granted to Robert H. Goddard, of Roswell, New Mexico.

No. 2,041,081, "Rocket Engine"; granted to Walter R. Menzies, of Milwaukee, Wisconsin.

No. 2,085,761, "Aircraft Power Plant"; granted to Alf Lysholm, of Stockholm, Sweden.

No. 2,085,800, "Combustion Apparatus"; granted to Robert H. Goddard, of Roswell, New Mexico.

No. 2,124,462, "Rocket Engine"; granted to Charles R. Cummings, of Fernwood, Pa.

No. 2,206,809, "Projectile"; granted to Paul E. J. Denoix, of Paris, France.

No. 2,283,863, "Rocket Engine"; granted to Ernest Achterman, of Westfield, N. J.

No. 2,286,908, "Auxiliary Turbine for Rocket Craft"; granted to Robert H. Goddard, of Roswell, New Mexico.

## JET PROPULSION CLASSIFICATIONS

With jet propulsion being employed in a number of various ways knowledge of the essential differences in application becomes of value. As an aid in distinguishing between the different types of jet propulsion, the terms with examples are defined.

Atmospheric - Mass of air accelerated by mechanical means. Example: Aircraft propeller.

Engine or ejector exhaust - Application of exhaust gases in aircraft for additional thrust. Example: Exhaust stacks of aircraft.

Thermal or hot air - Greater amount of necessary oxygen is obtained from surrounding atmosphere for combustion and thrust augmentation. Examples: Campini and Whittle planes.

Rocket - Powder or liquid propellants are carried along and exploded in the combustion chamber. Examples: Sky rocket, powder and usual liquid fueled rockets.

Hydraulic - Jet of water mechanically accelerated. Examples: Rumsey's steamboat (1787), Handley fireboats.

The only type of the reaction principle feasible in a vacuum is rocket propulsion. All the others are practicable only in atmosphere, or as in the last case, water.

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No. 2,286,909, "Combustion Chamber"; granted to Robert H. Goddard, of Roswell, New Mexico.

No. 2,307,125, "Rocket Launching Device"; granted to Robert H. Goddard, of Roswell, New Mexico.

Copies of patents may be obtained from the "Commissioner of Patents", Washington, D. C. Enclose 10c for each copy desired.

## NOTES AND NEWS

(Continued from Page 2)

dollars) to be expended on the development of an airplane capable of super-sonic speeds. Indications are that jet propulsion will be the method of motivation. Three well-known Japanese scientists, Professors F. Nakanishi, S. Kawada and Y. Nagai are to have charge of the project.

The Japanese showed considerable interest in the work of the American Rocket Society prior to the outbreak of war. The Imperial Army had a standing subscription to "Astronautics."

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The recent death of Nikola Tesla, famous inventor, brings to mind a prophecy made by this prominent scientist some dozen years ago: ". . . In rocket propelled machines . . it will be practicable to attain speeds of nearly a mile a second (3600 m.p. h.) through the rarefied medium above the atmosphere."

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"Rocket Flight", a two-page mimeographed bi-weekly is being published by Mr. Keith Buchanan, Box 148, Amsterdam, N. Y. A novel idea is the attachment of a photograph to the front page of each issue, depicting the contents of the issue. The small publication deals mostly with rocket events of the past, with comments by the editor. The present cost is 10c per issue, or four for 25c.

### CONTENTS



### MEMBERS PLEASE NOTE

The American Rocket Society has moved to new offices at 130 West 42nd Street, New York City. Please address all correspondence to this new address.

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